The Need for Drug and Poison Information – The Singapore Physicians' Perspective

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ABSTRACT

Introduction: There appears to be a significant prevalence of poisoning and adverse drug reactions in Singapore. However, the resources needed by physicians to assist them in the management of such cases are limited. This study examines the information resources currently utilised by medical professionals in assisting them in the management of poisonings and adverse drug reactions. The preferred features of an ideal Drug and Poison Information Centre in the local setting were also explored.

Method: A questionnaire survey involving all practicing physicians in Singapore to find out the current information resources utilised for Drug and Poison Information and the need for enhanced resources and its preferred form was looked at.

Results: A total of 1,071 practicing physicians responded forming 24% of all physicians in Singapore as of December 1997. Of these, 636 (61.3%) were general practitioners and the rest specialists. The main sources of poison information were Drug Index of Malaysia and Singapore or DIMS (73.7%), standard textbooks (70.1%), fellow colleagues (44.6%) and pharmacists (41.0%). In the opinion of most (82.4%), one well run and efficient Drug and Poison Information Centre was adequate for the whole island. The majority (58.9%) preferred that experienced individuals who could be consulted upon in times of need man such a service.

Conclusion: The study shows the need for enhanced drug and poison information resources. The local physician community also expects guidance and expert advice from a specialist. With this in mind, it is worthwhile examining in depth the issues surrounding poison and adverse drug reaction management and the need for readily accessible Drug and Poison Information resources in Singapore.

Keywords: poison information centre, drug information service, adverse drug reactions, poisoning

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INTRODUCTION

Poisonings and Adverse Drug Reactions (ADR) are medical problems that need to be recognised early and dealt with promptly to improve outcome. It may seem that poisonings and adverse drug reactions (ADR) are infrequent events. This misconception has been dispelled with recent reports from the United States, where the American Association of Poison Control Centers[1] has recorded just over two million toxic exposures in 1997 averaging 8.8 exposures per thousand population. With regards to ADRs, a study in New York State[2] reported that 4% of all patients hospitalised suffered an ADR while in hospital. When extrapolated to the United States, over a million patients are supposedly injured and approximately 180,000 die each year due to these injuries in comparison to the automobile mortality of 45,000 for the same period. A meta-analysis[3] of prospective studies on the incidence of ADRs in hospitalised patients showed the overall incidence of serious ADR at 6.7% and fatal ADRs at 0.32% of hospitalised patients. Similar findings were noted in a study done on admissions to a paediatric hospital[4].

In a recent study[5], it was noted that poisonings and adverse drug reactions accounted for a significant number of physician consultations in Singapore. It was also noted that most of the physicians were keen on managing these patients on their own. It was felt that the timely provision of the necessary guidance in the form of expert advice based on the latest literature and clinical experience will be an invaluable tool in assisting the doctor to better manage these cases.

In another study done on four pharmacist operated Drug Information Centres (DIC) located at local hospitals in Singapore in 1996[6], it was noted that the physicians (46.6 - 56.5%) were the major group of enquirers, followed by pharmacists (29.2 - 88.2%), nurses (0.7 - 17.2%) and other allied healthcare professionals (1.4 - 4.2%). It was also found that there were several enquiries from persons outside the hospital (6.6 - 19.9%), usually healthcare professionals in other institutions. The questions covered a wide spectrum including doses, availability of medications, identification, drug safety, compatibility issues,

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interaction, contraindications, adverse drug reactions and forensic issues, amongst others.

In countries where a Drug and Poison Information Centres exists, medical professionals are likely to use this service to obtain information and are satisfied with the information received in most cases.

Locally, the use of practice guidelines and other information resources in the management of patients who present with poisoning or adverse drug reactions has yet to be analysed.

The purpose of this study was to determine the current information resources utilised by Singapore physicians in this regard and to understand their needs for drug and poisons information.

METHOD

A retrospective survey on current drug and poison information resources being utilised by practicing physicians and their need for enhanced drug and poison information services was conducted. A questionnaire was sent by mail to all local practicing physicians at their practice addresses as reflected in the Singapore Medical Council's (SMC) lists of registered medical practitioners for 1997[7]. The survey was conducted in May 1998 and reply facilitated by including a self-addressed envelope in the questionnaire package. The name of the responding doctor was made optional to maintain anonymity and elicit an unbiased response that will better reflect the opinion of the practitioners surveyed.

The questionnaire for this study was in English and made up of two pages printed double sided on a single sheet of paper. A cover letter describing the study and asking the physicians for their participation was attached. Questions in the survey covered a number of areas as follows:

i) The first section included the survey population demographics including type of practice (hospital and clinic based general practice as well as institution or private practice based specialists) and years of clinical practice. General Practitioners (GP's) included those formally trained in general practice as well as all other doctors not trained in any particular specialty. Institutional specialists were defined as specialists working in restructured/government hospitals as opposed to private specialists who were specialists working in a private clinic or hospital.
ii) The current sources of information on drugs and poisons were elicited from a list of suggested options (textbook, DIMS, journals, fellow colleagues, pharmacists, Internet, drug representatives, drug/poison information centres ond others).
iii) The need for a drug and poison information services (DPIS) and its preferred form was next addressed. This included the physician's individual need and his or her own view on whether such a service should be accessible 24 hours a day, and if it should be manned by staff, and if so by whom (clerk, specially trained poison information specialist, drug representatives, pharmacists, nurses, doctors, clinical toxicologist or others). The type of information (pharmacological, toxicological or other information) sought was also included in the survey. Finally, the opinion of physicians with regard to the number of such services, its location and funding were addressed.

All returned questionnaires were collated for one month from the day of sending. No questionnaires were received after this date and no attempt was made to pursue the non-responders, as their identities were unknown.

STATISTICAL ANALYSIS

The questionnaires returned were entered into a database and analysed using SPSS (Statistical Package for Social Sciences Version 10.0) and interactions between the different parameters were analysed using logistic regression comparing GPs and specialists, as well as comparing institution-based specialists and private specialists to the bivariate responses to the questions. To further analyse the effect of years of clinical practice to the type of response obtained, the responders were arbitrarily divided into junior physicians if they had less than or equal to five years of clinical experience and senior if they had five or more years of clinical experience. Logistic regression was used to analyse the statistical significance of years of clinical experience, divided into senior and junior physicians to the various bivariate responses to the questionnaire.

In order to determine if the responders were representative of the population of all physicians in Singapore, the mean years of clinical experience and proportion of specialists amongst the responders was compared to the entire physician population. The mean years of clinical practice of the entire physician population, was derived by taking the average of the years post-graduation, as reflected in the Government Gazette on the "Lists of Registered Medical Practitioners for 1997" in relation to the year the survey was conducted (i.e. mean years of clinical practice = 1998 – year of graduation from medical school/total number of practitioners).

The number of specialists in Singapore was inferred from the SMC register as doctors with at least one post-graduate degree.

RESULTS

Demographics

Of the 4,912 physicians who were surveyed, 447 survey forms were returned undelivered as the addressees were no longer in their current address for various reasons including resignation from service, change of address or gone overseas. This group of non-responders was excluded from the final analysis. Of the remaining 4,465 potential responders who were presumed to have received the survey forms 1,071 physicians responded, giving a response rate of 23.99%. The reasons for the remaining non-responders were unknown.

The demographics of the responders according to type and years of practice are shown in Table I. The responders included 59.3% (636) doctors who were general practitioners as compared to the proportion of general practitioners in the entire physician population (59.7%). The rest of the respondents comprised specialists from the various disciplines.

The number of junior physicians with less than or equal to five years of clinical experience was 21.2% and senior physicians 73.0% with the remaining undetermined. The average clinical experience of respondents was 14.19 (SD +/- 9.95) years with a range from 0.5 to 56 years of practice compared to the average for the entire physician population in Singapore, which was 14.79 years (SD +/- 11.41) with a range from 0 to 65 years. There was no significant difference between the responder and the entire physician population in Singapore, taking into account years of clinical practice and specialisation. Hence, it was assumed that the responders to the survey were representative of the physician population in Singapore.

Table I. Responders according to Type of Practice.

Type of Practice	Number (%)	Clinical Experience (N=1009)	
		JP (%)	SP (%)
GP (clinic based practice)	356 (33.2)	28 (2.6)	320 (29.9)
GP (hospital based practice)	280 (26.1)	192 (17.9)	81 (7.6)
Private Specialist (specialist in private practice)	153 (14.3)	0 (0)	148 (13.8)
Institution based Specialist (specialist in restructured/ government hospital practice)	248 (23.2)	7 (0.7)	233 (21.7)
Unknown	34 (3.2)		
Total	1,071 (100)	227 (21.2)	782 (73.0)

GP: General Practitioner
JP: Junior Physicians with <= 5 years of clinical experience
SP: Senior Physicians with >5years of clinical experience
N: Number who responded to question on years of clinical experience

Table II. Drug/poison information resources comparing GPs to specialists and between institutional and private specialists.

Drug/Poison Information Resources	% Physicians using this Resource	OR for GP to Specialist for Information Resource Adjusted for Years of Clinical Practice (95% CI) N = 1037	p value	OR for Institution-based Specialist to Private Specialist for Information Resource (95% CI) N = 401	p value	Odds Ratio for Junior to Senior Physician for Information Resource (95% CI)	p value
DIMS[ψ]	73.7	1.971 (1.459,2.664)	0.001	0.470 (0.298,0.741)	0.001	0.831 (0.600,1.151)	0.266
Textbook	70.1	1.438 (1.080,1.914)	0.013	1.104 (0.722,1.688)	0.647	1.068 (0.773,1.475)	0.689
Fellow colleagues	44.6	1.272 (0.974,1.662)	0.077	1.059 (0.700,1.600)	0.787	1.959 (1.456,2.636)	0.001
Pharmacists	41.0	0.288 (0.217,0.382)	0.001	1.303 (0.868,1.957)	0.202	1.249 (0.929,1.678)	0.141
Journals	27.7	1.018 (0.757,1.367)	0.908	0.707 (0.459,1.089)	0.116	0.366 (0.246,0.544)	0.001
PIC[λ] at HSA[κ] & DIS[∞](hospitals)	19.4	0.529 (0.374,0.748)	0.001	3.913 (2.151,7.117)	0.001	1.234 (0.863,1.765)	0.250
Drug Representatives	13.8	2.067 (1.371,3.117)	0.001	0.583 (0.303,1.124)	0.107	0.346 (0.195,0.614)	0.001
Internet	11.8	0.373 (0.247,0.563)	0.001	1.503 (0.869,2.599)	0.145	0.542 (0.322,0.914)	0.021
Others e.g. BNF[Δ], CD ROM based drug/poison databases	1.1	0.131 (0.030,0.561)	0.006	4.404 (0.538,36.065)	0.167	1.051 (0.287,3.850)	0.941

[ψ] Drug Index of Malaysia and Singapore
[λ] Poison Information Centre
[κ] Health Sciences Authority (formerly the Institute of Science and Forensic Medicine)
[∞] Drug Information Services
[Δ] British National Formulary

Current Drug and Poison Information Resources

The main resources used by responders for drug and poison information are listed in Table II. Drug Index of Malaysia and Singapore or DIMS (73.7%), standard textbooks (70.1%), colleagues (44.6%) and pharmacists (41.0%) formed the large bulk of the information resources. Drug representatives and Internet sources accounted for smaller portions of references.

General practitioners were more likely to use DIMS, textbooks, fellow colleagues and drug representatives as information resources as compared to specialists who tended to use pharmacists, Drug and Poison Information Centre, Internet and other resources more commonly. This was statistically significant for all except use of fellow colleagues (Table II). Both specialists and GPs were equally as likely to refer to journals as an information resource but this was not statistically significant.

Institution-based specialists were approximately four times more likely to use the Poison Information Centre (PIC), located at the Health Sciences Authority (formerly known as the Institute of Science and Forensic Medicine or ISFM) or Drug Information Services of hospital Pharmacy Departments (odds ratio or OR 3.913 {2.151,7.117}, p<0.001) compared to their counterparts in private practice. Private specialists have a tendency to refer to DIMS, drug representatives or journals for information.

Junior physicians (JP) were more likely to use fellow colleagues as an information source (OR 1.959, {1.456,2.636}, p<0.001) compared to more experienced senior physicians (SP) who tended to use journals, drug representatives and the Internet as an information resource. DIMS a comprehensive drug information resource was a favourite amongst GP's but interestingly there was a tendency for the more senior physicians (OR 1.203, {0.869,1.666}, p=0.266) to use it as an information resource although this was not found to be statistically significant.

The Need for Drug and Poison Information Services (DPIS)

A large percentage of those surveyed (1006 or 93.9%) felt the need for having access to DPIS while 24 respondents (2.2%) did not feel a need for access and the rest were unsure. General practitioners were keener to have access to such a service compared to specialists (OR GP to specialist 4.000 {1.644,9.735}, p = 0.002, N=1030). Amongst those who were not keen for accessing such a service, 17 out of 24 (70.83%) were specialists. Amongst the specialists, there were proportionally more private specialists who did not want the service, eight out of 151 (5.3%) compared to nine out of 246 (3.7%). This difference was however not found to be statistically significant with an odds ratio for institution-based specialist to private specialist 1.473 {0.556,3.904}, p<0.436 for wanting access to a DPIS.

The mean years of clinical practice of those wanting access to a DPIS was 14.01 +/- 9.87 (N=1002) compared to 18.88 +/- 10.61 (N=26) (p value 0.027), suggesting that the younger and less clinically experienced physicians were keener for such a system to be in place. In fact, none of the 26 respondents who did not want access to a DPIS were junior physicians.

Characteristics of the Ideal Drug and Poison Information Service

Rapid 24 Hours Access

A large majority (82.4%) of those who wanted access to such a service wanted it to be available 24 hours a day every day of the year. The rest were contented if the service were to operate during office hours between 0800 and 1700 hours. General practitioners were marginally keener for office hour access to a DPIS compared to specialists, 112 of 611 (18.3%) general practitioners compared to 59 of 365 (16.2%) specialist (OR GP to specialists 1.152 {0.817, 1.625}, p=0.420).

Amongst the specialists, institutional specialists were more likely to want 24 hours access but this was noted to be not statistically significant (OR institutional to private specialists for 24 hour access was 1.392 {0.796, 2.434}, p=0.246).

The mean years of clinical practice of physicians wanting 24-hour access to a DPIS was 13.13 +/- 9.58 (N=802) compared to 17.81 +/- 10.38 (N=172) for those wanting office hour's access (p<0.001). Junior physicians were more likely to want 24 hours access compared to more experienced senior physicians (OR junior to senior physicians for 24 hour access was 2.652, {1.622,4.339}, p<0.001). This probably parallels the practice hours of the younger physicians who tend to work both longer hours and also after office hours.

Need for Experienced Staff to Run a DPIS

Many of those surveyed (58.9%) preferred a DPIS, which is manned by experienced individuals (OR GP to specialist for a manned service was 1.707 {1.307, 2.230}, p<0.001, N=949). There was no significant difference between hospital and private specialists in this regard. The remaining (40.9%) felt links to a computer database on poisons was adequate. The mean years of clinical practice of those wanting access to a manned system was 17.62 +/- 18.57 (N=578) compared to 15.33 +/- 17.10 (N=401) for an unmanned system. The t tests for equality of means was statistically significant at p value of 0.047, equal variances not assumed. A statistically significant association between years of clinical practice and the need for a manned

Table III. Preferred provider of drug/poison information.

Information Provider	% Physicians Prefer	OR for GP to Specialist (95% CI)	p value	OR for Institution-based to Private Specialist (95% CI)	p value	OR for Junior to Senior Physician (95% CI)	p value
Poison Information Officers	39.1	2.163 (1.655,2.827)	0.001	1.118 (0.712,1.754)	0.629	1.075 (0.798,1.449)	0.634
Pharmacists	28.3	0.848 (0.644,1.117)	0.240	1.081 (0.696,1.677)	0.729	1.158 (0.842,1.594)	0.367
Clinical toxicologist	24.3	1.208 (0.899,1.623)	0.210	0.783 (0.485,1.265)	0.318	1.283 (0.921,1.788)	0.141
Doctor	12.8	1.610 (1.083,2.393)	0.019	0.438 (0.225,0.855)	0.016	1.416 (0.938,2.136)	0.098
Nurse	2.8	0.890 (0.421,1.884)	0.762	0.860 (0.268,2.758)	0.800	0.756 (0.284,2.011)	0.575
Drug representatives/ salespersons	0.6	0.313 (0.057,1.718)	0.181	–	–	0.875 (0.097,7.862)	0.905
Clerk	0.3	–	–	–	–	1.753 (0.158,19.422)	0.647
Others	0.6	3.163 (0.369,27.117)	0.294	–	–	3.532 (0.708,17.618)	0.124

service was noted (OR for years of clinical practice for manned service was 1.021, {1.007,1.035}, p=0.003). This suggests the preference of the more experienced senior physicians (434/725 or 59.9%) to a more conventional, physically manned system as opposed to the younger physicians (124/222 or 55.9%) who are probably better equipped to deal with an information technology based system.

The grade of staff manning such a service was preferably a poison information officer (39.1%), pharmacists (28.3%), clinical toxicologists (24.3%) or doctors (12.8%) (Table III). General practitioners preferred specifically trained poison information officers, doctors or clinical toxicologists to provide them with advice compared to specialists who preferred to obtain information from pharmacists and nurses. Drug representatives and clerks were not found to be an acceptable information provider by most physicians. Except for three general practitioners none of the other respondents were agreeable to having a clerk as an information resource person.

There was no statistically significant difference amongst junior and senior physicians with regard to the preferred information provider (Table III).

Type of Information Required

The type of information wanted included pharmacological information (86.7%) such as side effects of drugs, drug interactions, drug dosing, etc; and toxicological information (88.8%) including effects of poisoning by household, industrial, and environmental poisons (e.g. poisonous plants, animal bites and stings). Other non-pharmacological and non-toxicological information such as travel medicine related information was also expected by 12.4% of respondents. There were no significant differences between specialist and GPs or within institution-based or private specialist or years of clinical practice with regards to pharmacological information required. However, general practitioners were more inclined to want toxicological information from the DPIS compared to specialists (OR GP to specialist for toxicological information was 2.324 {1.613,3.349}, p=0.001). In particular, junior physicians were noted to be keener to access toxicological information compared to their more senior counterparts (OR junior to senior physicians for toxicological information 1.697 {1.029,2.798}, p=0.038). There was no statistically significant difference amongst institutional or private specialists with regard to need for toxicological information.

Number of Drug and Poison Information Services in Singapore

In the opinion of most (78.8%), one well-run and efficient service was adequate for the whole island (Table IV). Specialists were more in favour of a single service (OR specialist versus GP 1.466, {1.043,2.061}, p=0.028). Only 5% felt that there should be as many centres as the number of major hospitals i.e. six centres. The majority of the latter group, 27 of 48 (56.3%) were doctors based in restructured hospitals. Senior physicians are more likely to want one service compared to the younger counterparts (1.608, {1.129,2.291}, p=0.008). There was no difference in opinion amongst institution-based specialist and private specialist with regards to the need for a single service for the island compared to several such services (OR IS to PS 1.180 {0.668,2.085}, p=0.568).

Location of Drug and Poison Information Service

Most felt that this information resource should be located centrally at MOH (Ministry of Health) (69.5%) with

Table IV. Number of Drug/Poison Information Centres Requested by Physicians.

Number of Drug & Poison Information Centres	% Physicians who Requested (N)				
	Overall	Year of Practice		Specialisation	
		% of JP	% of SP	% of GP	% of Specialist
One	78.8 (747)	72.3	78.8	76.7	82.8
Two	8.9 (84)	8.9	8.8	10.3	6.4
Three	3.7 (35)	6.6	2.8	4.7	1.2
Four	1.8 (17)	3.8	3.8	2.3	1.2
Five	1.7 (16)	2.3	1.6	1.9	1.5
Six	5.0 (48)	5.6	4.8	4.0	7.0
Seven	0.1 (1)	0.1	0	0.1	0

the rest suggesting its location at all emergency departments (22.1%) or pharmacy departments of hospitals (11.6%) (Table V). Most general practitioners opted for such services to be located at MOH or all Emergency Departments as compared to specialists who preferred it to be located at pharmacy departments of hospitals or other convenient location. Institution based specialists were more inclined to have the services in pharmacy departments or other convenient location. This was however not found to be statistically significant. The years of clinical experience did not influence the choice of location of such a service significantly.

Of the respondents who prefer Emergency Departments as the location for the DPIS, the reason behind this may be the traditional availability of Emergency Departments on a round-the-clock basis and hence the impression that these departments may also be a more readily available resource for poison information. This group of respondents was more open to receiving poison information from nurses (5.1%) compared to the general physician population (2.8%).

Of those who opted for the pharmacy department as the choice location, many were already using the pharmacist as an information resource (62.6% compared to 40.6% for the general population) and were keen to continue with pharmacists as the resource person (55.3% compared to 28.3% for the general population). However, they were not as keen on paying a nominal fee for such service. Of the respondents who opted for the Pharmacy Department as the DPIS, 39.7% were willing to pay a nominal fee compared to 51.9% of all respondents.

Remuneration for Drug and Poison Information Services

It was noted that 51.9% of respondents did not mind having to pay for such services with general practitioners predominating (odds ratio of GP versus specialist for payment for such services 1.307, {1.008,1.695}, p=0.043). There was no difference in opinion amongst institution-based and private specialist regarding payment for services. Years of clinical practice did not influence the decision for payment. Charge per call (67.1%) and yearly subscription (32.9) were the favoured methods of remuneration with no significant differences between specialists and GPs. However, institution-based specialists were more inclined to favour subscription based payment compared to their counterparts in private practice (odds ratio of institution-based specialist to private specialist 5.578, {2.597,11.981}, p<0.001). This could be due the anticipated higher volume of usage of such services by institution-based specialist who provide round- the-clock cover to patients in public restructured hospitals. The mode of payment favoured by junior physicians was subscription compared to their senior counterparts who prefer pay per call (1.457, {0.934,2.274}, p=0.097). Again this could be due to the anticipated higher volume of demand for such services amongst the junior physicians who may have less experience in dealing with the complexities of medical therapeutics.

Table V. Preferred location of drug and poison information centre.

Preferred location	% Physicians Requested	OR for GP to Specialist (95% CI)		OR for JP to SP (95% CI)		OR for Institution based to Private Specialist (95% CI)	
			p value		p value		p value
Centrally at MOH	69.4	1.429 (1.092,1.869)	0.009	1.215 (0.877,1.683)	0.241	0.838 (0.547,1.281)	0.414
All Emergency Departments	21.9	1.389 (1.019,1.893)	0.038	1.131 (0.800,1.599)	0.485	0.693 (0.417,1.152)	0.157
Pharmacy Departments of Hospitals	11.5	0.508 (0.347,0.746)	0.001	1.269 (0.819,1.968)	0.287	1.708 (0.950,3.071)	0.074
Others e.g. Department of Forensic Medicine, Special Centre, Internet based	2.8	0.491 (0.367,1.619)	0.491	0.381 (0.114,1.267)	0.115	2.098 (0.569,7.741)	0.266

DISCUSSION

This study is the first attempt at trying to identify current information resources used by Singapore based physicians in assisting them manage patients with poisoning and adverse drug reactions. It has also explored the opinion of local physicians with regard to their need for drug and poison information resources and the preferred characteristics of an ideal DPIS in our local context. In a paper by TC Chao et al[8], the functions and workings of the PIC were discussed and the necessity for quick access to poison, drug and treatment information was noted to be mandatory in order to improve outcomes in patients affected by these problems. It has been possible with this study to evaluate the adequacies of such a PIC and to determine the needs of local physicians so that appropriate enhancements can be made to achieve this result.

National Drug and Poison Information Centre – Is there a Need?

The management of drug-related problems can be a complex issue. It is noted from the study that junior physicians being less experienced appreciate guidance from individuals who have practical experience and who are familiar with information resources in this field. This is clearly reflected in the large majority of physicians who have expressed interest in having access to a DPIS, which caters to this need. Of the 24 respondents who were not keen for such services, nine were institution-based specialists, eight were private specialists and the remaining seven were general practitioners. A possible explanation for this could be the multi-disciplinary support that is provided to institution-based specialists who function as part of teams where aspects of adverse drug reactions are managed by one member of the team not necessarily the specialist.

The most important function of a DPIS is to provide contemporary information on drugs, product toxicity, and adverse drug reactions and patient management. It is important to realise that there is no lack of information resources to get assistance in dealing with these problems. However, this information is found in many places and forms and time are required to collate this. Half the battle is to know where to find such information or knowledge. Most of these information resources carry generic information on drugs but none provide patient specific information, which usually requires the assistance of experts in the field. Time is also required to sieve through this massive information and the busy physician is faced with the task of dealing with controversies in the literature with limited recourse for consultation with experts in the field. The lack of co-ordination delays the treatment of patients with possible adverse outcome and incurs an increased healthcare cost from unnecessary investigations, treatment, referrals and hospitalisation. All these unnecessary sequelae could be averted by consultation with an authoritative source that provides the necessary guidance and advice on these issues. This will allow the physician to concentrate on managing his patients effectively and efficiently.

It is interesting to note that although computers and accessibility to the Internet are becoming commoner and easier, only 12.3% of doctors use the Internet for drug and poison information, and 1.3% use CD ROM based drug and poison information resources. The possible explanations could be the amount of time taken to surf the Net for information as well as the reliability of its content and the cost of software licences respectively. The lack of a human touch and interactions with another compatriot are further drawbacks to a totally information technology based solution to drug and poison information which could account for the low utilisation of these resources.

Preferred Features of The Drug and Poison Information Service

Accessibility

In a recent study which looked at the expectations of emergency physicians regarding services provided by their regional poison centres[9], it was noted that there was a good fit between emergency physician expectations and service provided by the poison centre in 94% of all services provided. It was noted that the expectation with the highest rating was 24-hour service, quick response and substance specific poison assessment and treatment recommendations. This view is reinforced in our study, where easy and timely accessibility of such a service on a round the clock basis was important to most respondents (82.4%).

Need for Experienced Drug and Poison Information Providers

The majority of physicians (561 or 58.01%) were keen on the provision of drug and poison information by experienced staff, of these 67.74% (380) were general practitioners. Another 40.12% (388) of the respondents were keen for having access to a computer database on drugs and poisons that they could access. In a study assessing the clinical toxicology resources used by emergency physicians in the United States[10], poison centres were frequently utilised and occasionally utilised for poison information in 66.1% and 27.6% of cases respectively. Only a small minority (6.3%) almost never used it for poison information. The

other frequently used resources included toxicology textbook (34.4%), in-house POISINDEX (15.6%) and expert colleagues (1%). The common reasons for accessing the poison centre was for information on acute symptomatic overdoses (53.1%), industrial chemical exposures (15.3%), chronic poisoning (12.8%) and less commonly for asymptomatic exposures (4.8%) and adverse drug reactions (4.8%).

Similar findings were made in another study[11], which found the Drug and Poison Information Center (DPIC) and toxicology CD-ROM databases as the most useful sources of information followed by paper databases of ED poison protocols and textbooks. An interesting point was that the DPIC was rated consistently high compared to CD ROM databases, which were generally excellent for those who have used them in the past. This probably expresses the need for a compendium of drug and poison information resources centralised into a single location that is readily accessible. It is however interesting to note that the Internet was not a preferred information resource amongst the junior physicians who are expected to have more exposure to information technology. This could indicate that although information technology is making rapid advances in interactive programs it might not still be the replacement for providing personal advice for drug and poison information at this point of time. This is expected as the experienced user who is familiar with where to look for the necessary information will find it in a timely manner and will hence be able to provide it also in a timely manner. Hence, doctors who may not be familiar with toxicology and information resources on toxicology will rather talk to someone with experience in the field than to access an unfamiliar database on toxicology, which covers exhaustively and extensively on the topic. Realistically speaking, poison information comes from a variety of sources including paper and electronic forms, as well as from the experience of staff manning the poison centre. It is unlikely that a purely Internet-based access to such a DPIC can achieve the objective of providing useful information rapidly in the near future.

Profile of Drug and Poison Information Providers

From the survey, it is noted that the preferred information provider is an individual specifically trained for this purpose and experienced at providing such information. The background of the individual, be it doctor, nurse, pharmacist, etc is of secondary importance. This is not unlike the poison information specialists who service poison information centres in the United States, and who are from a wide and varied background but who are specifically trained to provide drug and poison advice to physicians and members of the public. The use of poison protocols helps to facilitate accurate and timely disposition of information; and the back-up of an emergency toxicologist on call to take on difficult questions and reassure poison centre staff as well as end users of the service, further compliments the system.

Type of Information

The type of information provided by a DPIC is expected to cover a broad spectrum from toxicological and pharmacological information to other information on drug dosing, drug interactions, poisonous plants and animals, availability of antidotes, industrial, household and traditional medicine product contents, etc. In addition, such centres being so readily accessible are the first resource to be consulted in non-chemical or pharmaceutical incidents such as infectious disease outbreaks and bioterrorism. In the context of the present study it would imply that the DPIC is expected to act as a repository of information resources with an experienced individual who can administer and provide the necessary information in a timely manner to the information seeker.

In the study done on pharmacist operated drug information centres in Singapore[6], it was noted that drug dosing (30.8%) and availability (14%) were the most commonly asked information. This sharply contrasts the study findings. The reason could be the limited expectations of physicians in obtaining poison information from drug information centres. This could be due to the perception of physicians that the pharmacists running such centres have no toxicology knowledge or experience in managing poison exposures. Drug information centres are therefore not a replacement for poison information centers. However, it would be logical to state that there are some overlapping areas in drug and poison information that makes sense that they should be co-located to facilitate training of poison information specialists and for logistical reasons to run the centre effectively and efficiently.

Number of Poison Centres

In a study that evaluated the emergency department as a poison information resource[11], it was noted that personnel in the emergency department including both nurses and physicians gave poison advice. The information so obtained was correct in only 64% of cases compared to 94% of cases that were provided by the poison centres. In addition, 48% of all calls to the emergency departments resulted in advice to contact the poison centre. The reasons for this included a heavy workload in the emergency department resulting in lack of dedicated resources to handle these calls, lack of time to refer to references, inexperience in

dealing with detailed aspects of poison management and concerns about liability of providing incorrect answers to calls.

In the local context, emergency departments face similar problems of excessive workload, lack of dedicated resources and reference materials to handle such poisoning calls in an effective and consistent manner. The provision of a centralised DPIC will allow effective utilisation of such resources reducing duplication of similar resources that are present in the form of drug information services in the various hospital pharmacies and expensive licenses to poison databases that are kept in Emergency Departments. The lack of a choice due to the availability of a single operating DPIC will lead to less confusion in a time of emergency when information is time sensitive and important to the final outcome. This will also facilitate a pre-programmed number to be entered into the telephone service which will allow the physician quick access to information at the touch of a button.

Location of Centre

The choice of location of the DPIC was influenced by multiple factors based on the perception of the individual physician. For the GP, emergency departments, which provide 24-hour service all year round, appear to be a reliable location for a DPIC as reflected in our study. However, in reality this may not be the ideal location as there is a lack of dedicated manpower, time and reference materials that are readily available to effectively carry out this function. The costs of maintaining duplicate resources in several emergency departments in a small place like Singapore can be considered a waste of health dollars.

For institutional specialists working in the hospital environment, they are familiar with the drug information services located in the pharmacy departments of their respective hospital and are accustomed to the pharmacological information that they provide. These physicians probably feel that the provision of poison information by the DIS's is a natural extension of the DIS's role. The trust gained from obtaining information from the pharmacists is translated to confidence in the toxicology information provided as well.

The large majority prefer to have this service located in MOH. The underlying reasoning could be the perceived idea that the government, taking into account the regulatory and registry functions as well as its public health service nature of this service should shoulder the responsibility of this service. It was noted that a majority of these physicians were also not as keen to pay for such services possibly based on this reasoning.

Remuneration for Drug and Poison Information Services

It is not unexpected that despite the strong demand for DPIS, only approximately half of the respondents were willing to pay for the services. Like in any other project, financial support is of utmost importance. According to WHO's recommendation for establishment of drug and toxicology information centres in developing countries[12], government authorities are advised to take the initiative to officially recognise and fund such services. In addition, DPICs should be free to solicit funds from consultations, universities, hospitals, and associations of industry and commerce, philanthropic groups and other organisations without compromising their neutrality. In any case, the functions of the DPIC tend to promote health education and safety issues benefiting both the public and industry.

Roles of a National Drug and Poison Information Service

The roles of a Drug and Poison Information Centre can be summarised as follows:

Information Provider

Despite the complexities of adverse drug effects, interactions and poisoning most physicians are still keen to manage most cases on their own. The information on such management though available is not easily acquired in a timely fashion that would help expedite the management of these patients. It is the role of the DPIC to bridge this gap and consolidate a centralised database of poison and drug information that is readily available and easily accessed. The links these centres have with specialists experienced in the various aspects of pharmacology and toxicology will be further plus points that allow primary physicians to better manage their patients.

The need for a centralised database and expert advice service on pharmacological and toxicological problems is currently felt to be a necessity for assisting the physician in the total management of the patient taking into account the complexity of today's therapeutic agents and their potential drug interactions.

Toxicovigilance

In addition to a proactive role in the management of poisoned patients, DPICs can be crucial in monitoring the latest trends in poisoning. This aspect of toxicovigilance will keep the frontline physicians abreast of current toxicological threats to the general public and improve awareness resulting in early detection and treatment of poisonings with improved clinical outcome. The sentinel role of a National DPIC for monitoring adverse drug reactions will further enhance the position Singapore has taken as a centre of medical excellence with therapeutic trials for new drugs.

The importance of daily, ongoing statistical analysis of Poison Control Centre data for timely identification of poison clusters is noted. This monitoring has been utilised to detect and deal with carbon monoxide poisoning outbreaks[13]. The objective is to enhance early detection of poisoning outbreaks and hence allow for prevention of poisonings and early detection. This will help minimise community exposure to hazardous materials.

The limitations of a voluntary reporting system to capture such information are self-explanatory. On the other hand, the capturing of such information while in the process of assisting the physician in delivery of health care by way of drug and poison information and advice benefits the patient, the physician and the nation all at the same time.

Poison Prevention

Poison prevention involving public education programmes on toxic hazards in the environment and techniques to poison proof homes to prevent accidental poisoning in the younger population are other aspects that poison centres are better positioned to institute. This will help reduce the incidence of accidental poisonings that occur at the work place or home.

The benefits to chemical and pharmaceutical industries are numerous. In assisting them with provision of information on adverse effects of chemicals, chemical safety can be assured and health problems prevented. This will assist in the development of such industries with significant economic growth for Singapore.

Chemical Incident/Disaster Preparedness

The importance of poison centres in the contingency planning for chemical disasters will help the local community prepare for the potentially dangerous consequences of chemical incidents and avoid the repeat of cases such as in the Bhopal disaster.

Cost Effectiveness of a National Drug and Poison Information Service

The need for a DPIC in providing information and consultancy support to physicians managing a wide variety of toxicological problems is noted. Most benefits gained from such a service are intangible and as such are difficult to quantify. Several studies recently have managed to demonstrate cost effectiveness of such a service[14-16]. This will hopefully help change the mindset that this service is not an economically viable option.

CONCLUSION

Considering the fact that the most common intervention provided by physicians in the management of illnesses involves the use of drugs, it is not surprising that there is a significant number of poisoning and ADR related problems in Singapore as noted in a recent study[5]. Most of these patients present to GPs who form the backbone of the primary health care service. These physicians are keen to manage and follow up these patients on their own provided they have the resources. Hence, it is not difficult to appreciate the usefulness of DPICs in assisting the physician to effectively and efficiently manage his patients by providing the necessary information in a timely manner.

A strong need to have access to DPIC services is evident from this study. Rapid, timely access to experienced individuals in the field of toxicology is urgently felt needed. A single centralised database in the form of a National DPIC could help co-ordinate drug and poison information flow avoiding duplication of resources and resulting in cost effectiveness and efficiency of such a service. This will make it possible to deliver such information in a timely manner to the required persons. The presence of a central body responsible for information disposal will allow auditing and quality control of information given. This will help to ensure dissemination of accurate and reliable information that is evidence based on the latest in medical literature.

Recognising the contribution of poisonings and adverse drug reactions to patient morbidity and mortality, several countries have taken the initiative to form Drug and Poison Information Centres. The primary role of these centres in the United States, United Kingdom, Europe and many other countries around the world has been to provide accurate and reliable information on drugs and toxins in a timely fashion to physicians managing toxicological problems. The important role of Poison Information Centres in the treatment and prevention of poisonings is appreciated[17]. In particular, morbidity and mortality associated with poisoning have continued to decrease in Europe as testimony to the commitment and expertise of many clinical toxicologists and services provided by Poison Control Centres[18]. These countries have surmounted initial frontiers of poison information dissemination and are bracing themselves to meet new challenges in this realm.

In the light of the opinion of the physicians surveyed, it is obvious that a single, well-run and efficient service is justifiable for a small country such as ours. Not taking into account the savings in costs and efficient utilisation of limited resources, the presence of a single authoritative organisation will provide clear guidelines for proper poison management supporting the evidence based medicine concept of patient care. Contributing in this manner, DPICs would be of use to physicians and of benefit to our patients.

LIMITATIONS OF STUDY

There are several limitations to this study that should be borne in mind when interpreting and extrapolating the results. The responders formed only 24% of the total physician population and due to the nature of the study no attempt was made to find out the opinion of the non-responders. Hence, generalisation of the results to the entire physician population should be done cautiously.

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Survey on "Determining the Prevalence of Adverse Drug Reactions and Poisonings Encountered by Practising Physicians in Singapore"

Questionnaire

Part I – Personal Data

1. Name (optional): _____
2. Address of practice (optional): _____
3. Years of medical practice (state only number of years of clinical practice): _____
4. Type of practice (tick the single most appropriate box):

   ☐ General Practitioner (clinic based)

   ☐ General Practitioner (hospital based) including medical officers based in polyclinics, restructured and government hospitals, private hospitals, Singapore Armed Forces, etc.

   ☐ Specialist (institution based i.e. in restructured or government hospitals)

   ☐ Specialist (private practice, private hospitals)

   ☐ Others: Specify

Part 2

5. Have you, in your practice, faced any of the drug-related problems mentioned below?

Drug/Toxicological Problem	Yes	No	If yes, state approximately how many such instances over a year	State your current management of each problem as described below*
Drug side effects	☐	☐	_____	_____
Drug allergies	☐	☐	_____	_____
Drug interactions	☐	☐	_____	_____
Poisonings (by drugs, chemicals, poisonous bites and stings)	☐	☐	_____	_____
Adverse effects of traditional medications	☐	☐	_____	_____
Smoke inhalation	☐	☐	_____	_____
Alcohol related problems e.g. alcohol abuse, intoxication or adverse effects (gastritis, liver disease)	☐	☐	_____	_____
Others (e.g. drug abuse and glue sniffing)	☐	☐	_____	_____

* a = self treat and follow up, b = initiate treatment and refer to A&E, c = refer directly to A&E, d = consult Poison Information Centre or Drug Information Service for advice, e = others (specify in space provided).

6. What is your usual source for poison and drug information? (You may tick more than one box.)

☐ Textbooks ☐ DIMS (Drug Index of Malaysia and Singapore) ☐ Journals
☐ Colleagues ☐ Pharmacist ☐ Internet
☐ Drug representatives ☐ Drug/Poison Information Centre (ISFM) and Drug Information Service (hospitals)

7. Would you like to have access to a Poison and Drug Information Service, where you can obtain information drug/chemicals and advice on management of drug-related problems mentioned above?

☐ Yes ☐ No

8. If yes to Question 7, what would you prefer? (If no to question 7, proceed to question 16.)

☐ Access to the service 24 hours a day
☐ Access only during office hours (0800 - 1700 hours)

9. How would you like the Information Service to be run?

☐ Manned (staffed by an officer) ☐ Unmanned (access to a computer database)

10. If it is a manned service, who do you think should be providing you with answers to your questions?

☐ A clerk
☐ Poison Information Officers (personnel specifically trained to look up and evaluate drug information from computer database and reference books)
☐ Drug representatives/Salespersons
☐ Nurse
☐ Pharmacist
☐ A doctor
☐ Clinical toxicologist (physician specialising in poisonings and their management)
☐ Others (please specify): _____

11. What information would you want a Poison and Drug Information Service to provide you? (You may tick more than one box.)

☐ Pharmacological information e.g. side effects of drugs, drug interactions, drug dosages, etc
☐ Toxicological information e.g. effects of poisoning, household products in poisoning, industrial poisoning, chemical injuries, environmental poisons such as poisonous plants or animal bites, etc
☐ Others (please specify): _____

12. Where do you think such a Poison and Drug Information Service should be based?

☐ Mnistry of Health
☐ All A&E departments
☐ Pharmacy departments of hospitals
☐ Others (please specify): _____

13. Would you be willing to pay a nominal fee to run the service? ☐ Yes ☐ No

14. If yes to question 13, how do you think this should be charged?

☐ Charge per call ☐ Yearly subscription

15. In your opinion, how many 24-hour Poison and Drug Information Centres should Singapore have?

_____

16. Comments (any other suggestions): _____